A new interpretation of guided implant surgery to achieve an optimal result in the esthetic zones

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ABSTRACT:

Guided Implant surgery was first introduced at the beginning of the year 2000. Now, more than fifteen years after its introduction, systems have shown more features and simplified their utilization.

Digital dentistry is evolving very rapidly and the digital workflow is becoming a routine in many dental offices.

Surgical techniques in bone regeneration have also become more manageable and the advent of new biomaterials has simplified these procedures. This article will show how we can combine the use of regenerative procedures, and achieve a nearly perfect reconstruction of the bony housing and the surrounding soft tissue using guided surgery to maximize the esthetic result.

1. Introduction :

At the beginning of the 21st century, dental companies have introduced the use of software reading and interacting with Dicom data originating from dental scans. These softwares allowed the computerized planning of prosthetically driven restorations on dental implants placed in a flapless procedure.

This was a breakthrough because until then dental implants were placed with free hands and adopting a flap procedure.

One of the greatest benefits of guided implants is the possibility to place the fixtures through a customized template preventing the need of a more traumatic open flap procedure. The literature has shown extensively that every time a clinician addresses an area with the aid of a full thickness flap there is a later minimal remodeling of the bone leading to minimal changes, but sufficient to create a slight gingival recession in the soft tissue.

This problem might reflect into the prosthetic restoration resulting in a wider, longer or anyway less biomimetic tooth replacement.

2. Case Presentation

A female 42-years-old patient presented to the office referring increased mobility to the upper left incisor. The subsequent rx showed a non vital tooth restored with post and core and the signs of a previous apicoectomy. (Figures 1,2,3)

The patient was sent immediately to take a CBCT to evaluate the extent of the lesion and to design a treatment plan.

Fig. 1

Fig. 2

Fig. 3

The CBCT showed in the axial cuts referring to the tooth how the bone loss was extensive and the tooth was deemed hopeless. The tooth is positioned very buccally and its extraction will probably cause a horizontal collapse of the soft tissue (Figures 4,5).

Fig. 4

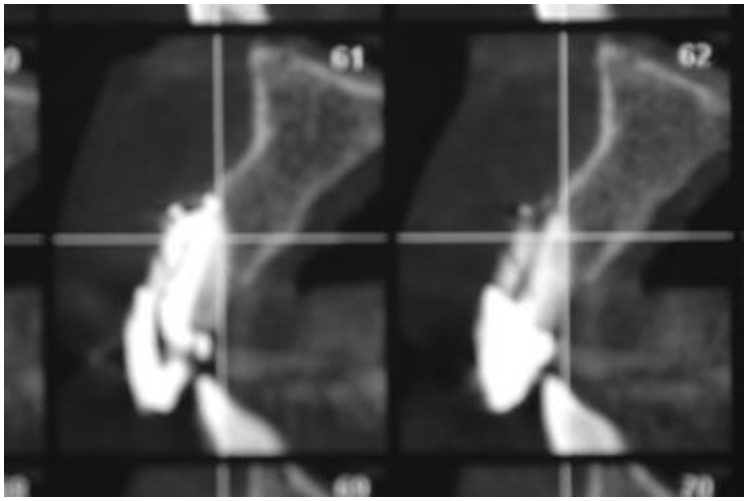

Fig. 5

3. Treatment planning.

The first step was to take impressions of the patient's mouth in order to fabricate a fixed temporary bridge to replace the tooth after extraction. Patient was placed under antibiotic therapy starting two days before surgery (amoxicillin 2 grs a day). On the day of the procedure, the patient was anesthetized with Articaine 1:200.000 and local infiltration. The tooth was gently extracted and the socket debrided with hand and rotary instruments and washed with peroxide and chlorexidine (Figure 6). A full thickness flap was raised from the distal of the right upper incisor to the distal of the lateral left incisor in order to expose the area of the bony lesion (Figure 7). A buccal view shows the complete loss of the buccal plate thus the necessity of bone graft to augment and restore the area to a normal volume (Figure 8).

Bone augmentation was performed with the use of a collagenated porcine bone graft (MP3 Osteobiol ® by Tecnoss, Coazze, Italy) (Figure 9). In order to protect the bone graft, two collagenated resorbable membranes (Osteobiol ® Evolution by Tecnoss, Coazze, Italy) were placed in layers. The function of the membranes was to isolate the connective tissue and the epithelium from the area grafted and to support and increase the thickness of the soft tissue (Figures 10, 11). After completion of surgery, the tooth was replaced with an adhesive temporary Maryland bridge (Figure 12).

Fig. 6

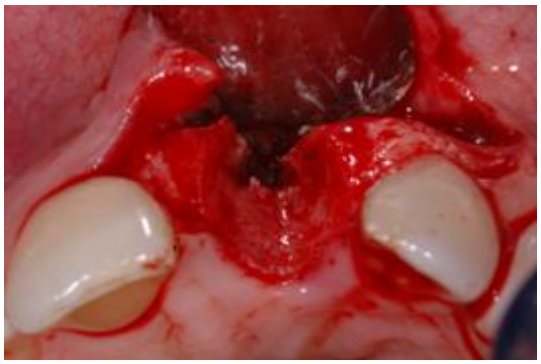

Fig. 7

Fig. 8

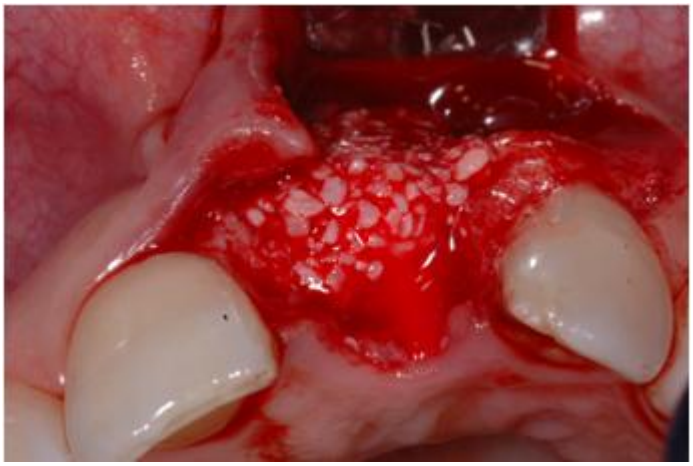

Fig. 9

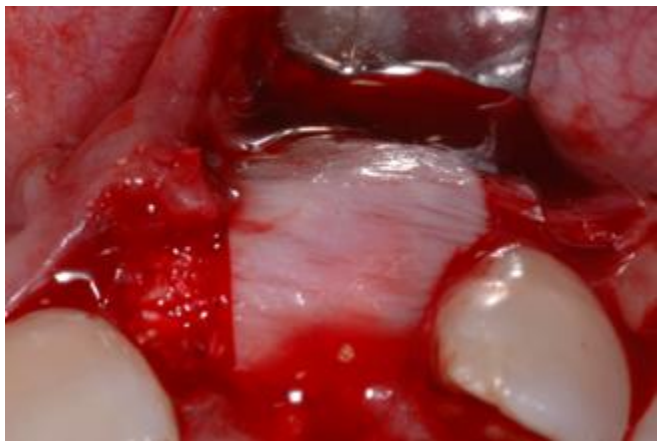

Fig. 10

Fig. 11

Fig. 12

Twelve months after surgery, the area was re-evaluated and a new CBCT was taken to evaluate the regeneration (Figures 13-13a) and the clinical evaluation of the area showed a very good profile in both vertical and horizontal aspects, the interdental papilla was present at both mesial and distal end (Figures 14-15-16).

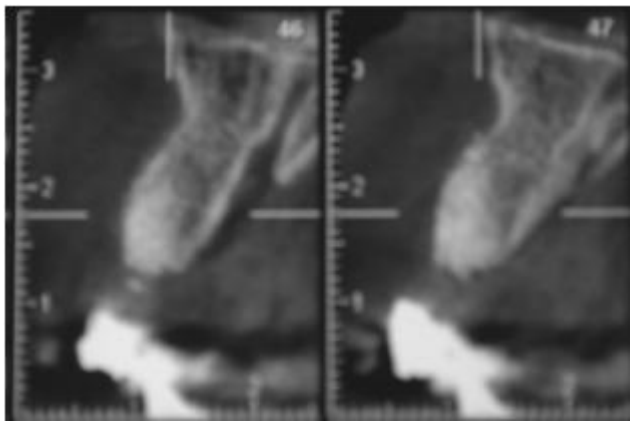

Fig. 13

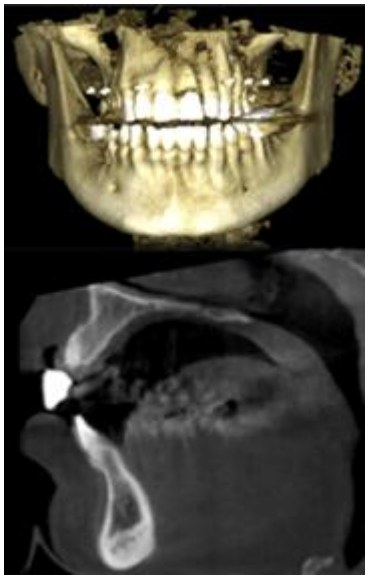

Fig. 13a

Fig. 14

Fig. 15

Fig. 16

Since the guided bone regeneration procedure proved successful in restoring the missing bone and also the soft tissue were found in the expected position, we decided to address the problem using guided implant surgery to avoid the flap approach and to further condition the soft tissue with a fixed temporary crown.

A new CBCT with a diagnostic stent was taken in order to plan the subsequent implant procedure. The diagnostic stent is fabricated with gutta-percha reference points placed in different positions in both the buccal and lingual aspect. The patient undergoes the CBCT evaluation or a dental scan wearing the stent, and later the radiologist takes a scan of the stent alone. Implant navigation software has the capability of superimposing the two exams and providing the clinician with a model of the head of the patient as well as a model of the stent. Working in the assial section of the program, the clinician has the possibility to plan the placement of an implant: in the right prosthetic position (as referenced to the stent), at the proper depth, choosing the best possible angulation and 3D position, and also interacting with a variety of prosthetic components provided in the software's library (Figures 17-18-19)

The planning software allowed the planning for a fixture 5 mm wide by 11,5 mm (Figure 19).

Fig. 17

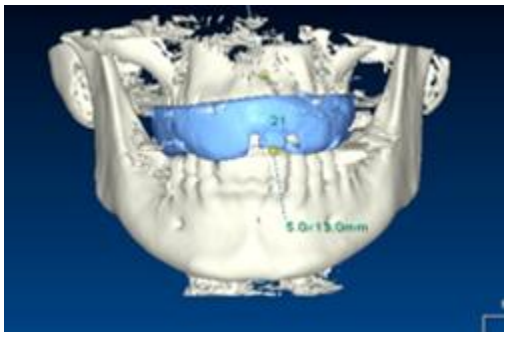

Fig. 18

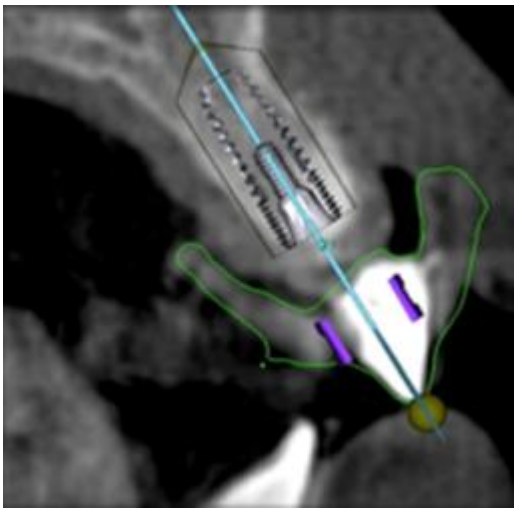

Fig. 19

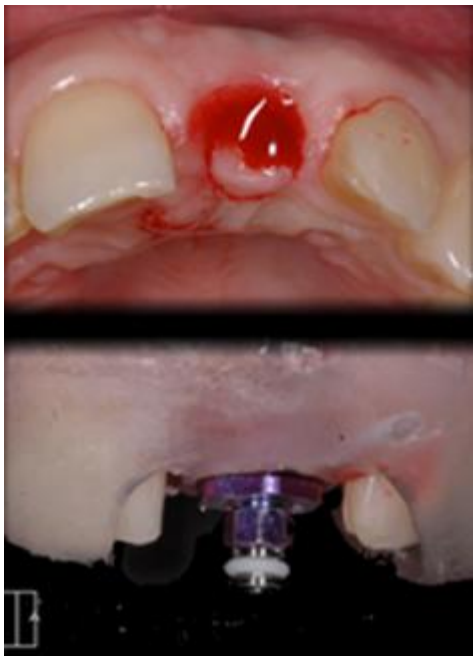

Fig. 20

With the guided approach for a single tooth, the procedure becomes very simple and quick, the surgical stent lies on the adjacent teeth and facilitate the insertion of the selected fixture (Figure 20). The ISQ of 84 suggested the possibility to immediately load the implant with a temporary crown (fig.21-22), the rx showed a perfect crestal position of the implants that is a key factor in supporting the temporary crown and condition the soft tissue.

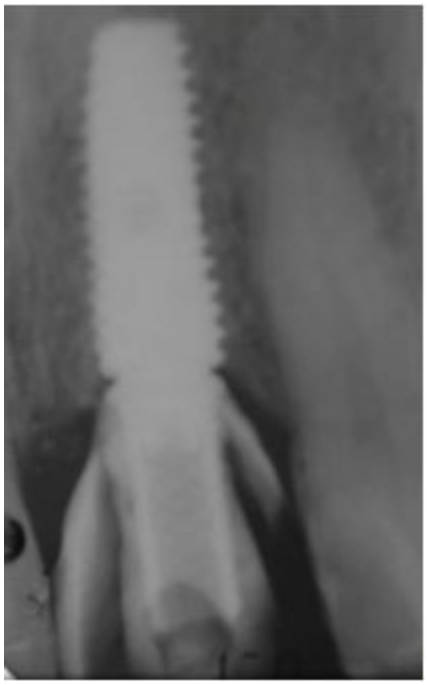
Fig. 21


Fig. 22

Some months later and after further conditioning, the final impression was taken with a customized impression transfer. This procedure provides the dental technician all the vital information regarding the soft tissue position, its compression, and facilitates the creation of the proper emergence profile (Figures 23-24-25).


Fig. 23


Fig. 24

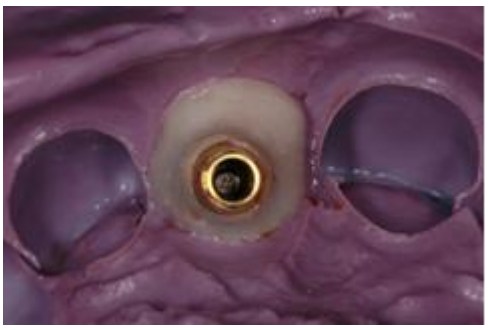
Fig. 25

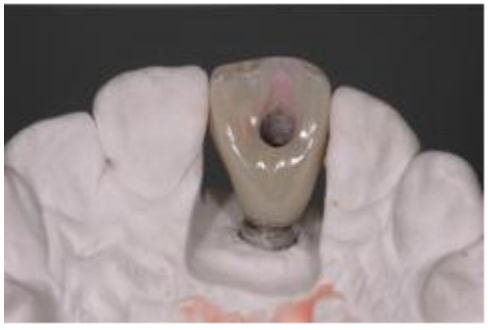
Fig. 26

Fig.27

Fig.28

Fig.29

Fig.30

The laboratory technician then can produce a Lithium disilicate crown screw retained into the implant (as planned in the implant navigation system) and the procedure of replacing the temporary crown with the final restoration is just a matter of minutes. (Figures 26-27) The final restoration respects all the parameters of biomimetic and replaces the missing natural tooth in an invisible way, restoring a natural and beautiful smile to the young lady (Figures 28-29-30).

At the one year follow-up visit, the peri-apical radiograph taken shows an excellent stability of the bone and fixture complex and a full face view of the patient displays the good integration of the crown in her smiling face.

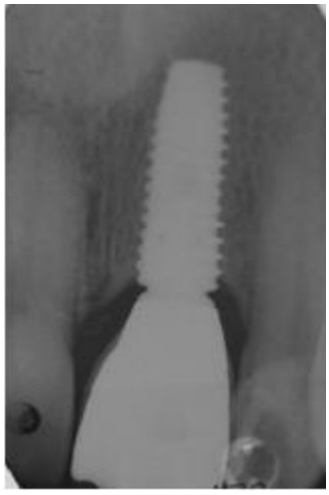

Fig. 31

Fig.32

4. Discussion:

Implant dentistry is today the most predictable way to replace missing teeth. Very often tooth loss is associated with a volumetric change in the soft and hard tissues. Many different authors have shown that these changes can reach up to 50% of the original bone volume in the first year after extraction.

A number of studies have indicated a way of preventing this problem, suggesting a treatment called ridge preservation. The careful extraction followed by the application of a bone graft or bone substitute in the extraction socket has shown from the animal model to the human model that can help reducing the remodeling in a significant way. When ridge preservation is not possible, an augmentation procedure called GBR (guided bone regeneration) can be a valid alternative or even the next procedure suggested in order to restore the best possible proportions in both hard and soft tissue. In clinical situations where the volumes had been restored (like the case presented in this paper), an additional aid came from software technology by means of implant navigation systems. First, this software was developed to place implant in fully edentulous cases, but as experience built authors have shown how INS can be very useful also in cases of single tooth replacement or in all those clinical situations where esthetics becomes important. Modern dentistry is becoming more and more oriented towards the use of digital devices, dental scanners and mills. The treatment modality described in this paper is a staged approach that allows the clinician to take advantage of all the newest techniques and procedures in terms of biomaterials, surgery and prosthetics in order to achieve an optimal esthetic and functional result.

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